CHAPTER 14

SMALL SEWAGE TREATMENT FACILITIES

14-1. General considerations. Treatment plants handling less than 1.0 mgd are generally considered small treatment plants. The principles of design are no different, but the choice of equipment will usually differ from that used in large plants. This is usually due to the effect of economies of scale, whereby certain operations are economically feasible only on a large scale. This is often the case for certain sludge handling systems and most advanced treatment operations. Small plants must make larger safety factor allowances for flow variation and temperature effects relative to total wastewater flows. Smaller plants inherently have less operational flexibility; however, they are capable of performing effectively and efficiently. These small treatment plants may consist of wastewater stabilization ponds, trickling filter plants, physical-chemical plants, extended aeration activated sludge plants, and septic tanks. Design criteria for septic tanks are given below. Criteria for other processes have been presented in previous chapters.

14-2. Septic tank design factors. Septic tanks, with appropriate effluent disposal systems, are acceptable as a treatment system for isolated buildings or for single-unit residential buildings when permitted by a regulatory authority and when alternative treatment is not practical. When soil and drainage characteristics are well documented for a particular site, septic tank treatment may be permanently feasible. Septic tanks perform settling and digestion functions, are effective in treating from 1 to 300 population equivalents of waste, but will be used only for 1 to 25 population equivalents, except when septic tanks are the most economical solution for larger populations within the above range. Minimum size will be at least 500-gallon capacity. In designing tanks, the length-to-width ratio should be between 2:1 and 3:1, and the liquid depth should be between 4 and 6 feet. Detention time depends largely on the method of effluent disposal. When effluent is disposed of in subsurface drainage fields, 24 hours detention time based on average flows is required. The septic tank must be sized to provide the required detention (below the operating liquid level) for the design daily flow plus an additional 25 percent capacity for sludge storage. If secondary treatment such as a subsurface sand filter or an oxidation pond is provided, this can be reduced to 18 hours. Open sand filter treatment can further reduce detention time to 10 or 12 hours. Tile field and leaching well disposal will be limited to small facilities (less than 50 population equivalents). For larger operations, discharge of effluent is usually through dosing tanks which periodically discharge effluent quantities near 80 percent of the drainage system capacity.

14-3. Subsurface irrigation design factors. Subsurface irrigation can be used in conjunction with septic tank treatment when soil conditions

permit. Percolation tests must be performed as required by the U.S. Public Health Service, and the ground water table at the highest known or anticipated level must not reach the invert of the lowest tile line.

14-4. Package treatment plants. Complete package treatment plants can be obtained from various manufacturers; these plants may present a practical and flexible solution to many wastewater handling problems. However, the modified activated sludge plants may require relatively high amounts of electrical energy consumption to operate aeration equipment. The systems are usually based on biological treatment, with modified aeration techniques such as extended aeration. These systems are capable of handling population equivalents of 10 to more than 1,000, but will be considered for flows of 0.1 mgd or less. Some prefabricated plants may be relocated, depending on size and original construction. Specific design details are obtainable from individual manufacturers.